With The author's compliments.

THE

INFECTION OF EPIDEMIC INFLUENZA.

BY

WILLIAM SQUIRE, M.D., F.R.C.P.,

Physician to the St. George's (Hanover Square) Dispensary;
Member of the Epidemiological Society of London,
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THE present epidemic of influenza affords abundant evidence for comparison with accounts of past epidemics under various aspects that need full consideration. The subject of the present inquiry is approached from two sides:—First, of infection as an epidemic agent; and second, of its more limited action in communicating the disease from person to person; for it will be generally conceded that, for influenza, this is not the main or only means of conveyance, as in some other diseases, like small-pox, that become epidemic. Whatever the general conditions or "influences" concerned in the reappearance of the disease amongst us, a something to be influenced—a germ or agent—is presupposed. As stated twenty-five years ago by Dr. Parkes, "there must be a continual reproduction of the agent to a greater or less extent in different places. Now, this reproduction must either be in the air or in the bodies of the sick, in which latter case the agent would be a true contagion."* In some specific fevers both modes of increase are possible, as in remittents which are not infectious, and in cholera and influenza which are, though in a different manner from the directly contagious maladies; but in all cases the process is a vital one, and the laws determining the reproduction and distribution of infection are to be explained on biological and not on physical principles. Probably no scientific inquiry has been so much hindered by misapplied analogies or vague terms as this one on the spread of epidemic diseases; whether the analogy be drawn from animate or inanimate nature,

* Reynold's "System of Medicine," 2nd edition, vol. i., p. 38.

whether the advance of an epidemic be compared to insects in the air, to swarms of locusts, or the advance of armies on the one side, or to clouds or waves or masses of propelled matter on the other, the assumption that the invading material has all come from without vitiates the whole conception, and leads to conjectures that the infecting particles have been propelled over thousands of miles, have travelled with or against the wind, have been deflected or divided in their course, while the really essential condition of continual reproduction in the community attacked is lost sight of or ignored. Each class of analogy has led to errors of its own; the animate to various guesses of hybridity, to the straw-fungus theory and the like; the physical to neglect of what, for a passing purpose, was called "the first droppings of the thunder shower," to the westerly progress of epidemics, and to other opinions less directly calculated to impede prevention; for a false view of the nature of any special infective disease leads to error and uncertainty in our methods of prophylaxis.

The very limited or doubtful quality of infection shown by the earlier cases of influenza noted among us before last December distinguished them from what had been observed in previous epidemics and from what has since occurred; yet these cases are evidence that the disease itself had again been roused into activity, and had their part in the evolution of the epidemic. So it was in most of the capitals of Europe; no sooner had a telegram announced the absence of this epidemic, and the presence of simple catarrh, than we heard of its attacking the postmen, the railway servants, or the men in barracks. The attacks at a given time were too numerous to be attributable to direct personal infection, and mostly at such an interval from the earlier cases as to favour the idea of an active local reproduction of the specific germ, either in the air or in aqueous or other air-borne particles of the place. The earlier winter of north-eastern Europe and its sudden changes, together with less known conditions of wider scope, may have determined the first epidemic manifestations of an old scourge in that quarter, but a renewed energy of the same specific kind was at the same time observable over half

our hemisphere: too large an extent for any theory of conveyance to explain. Nor is the account of the advance of the epidemic in Russia explained satisfactorily on any such hypothesis. The earliest record of the presence of influenza as lately brought from Russia by Dr. Clemow is from Tomsk on Oct. 17th; we have an account of it as epidemic from Kolomna, south of Moscow, and from Wassili-Ostrow at the same time. It was at Viatka, in the north-east of Russia, on Nov. 13th, and before that in both St. Petersburg and Cronstadt. Influenza has long been endemic at St. Petersburg.

That the infection in these early outbreaks was reproduced in great measure external to the living body, and to a certain extent air-borne, is evident from its mode of action; and the disease to which it gives rise is like other malarial infections, in that one attack is not protective against a recurrence, as is the case with most of the directly infectious diseases whose germ is only reproduced in the bodies of the sick. Herein is one of the great differences observed in the incidence of influenza as compared with such infections as scarlet fever or measles. In these two, men are less liable to suffer than children, even if they are not protected by a previous attack, and are less exposed than women to an infection chiefly limited to the sick room; in measles an additional reason for the immunity of adults is the rarity of second attacks. We can hardly estimate the full effect of those differences in giving a distinctive character to the epidemic. Another cause of difference is that where infection is not limited to the sick person and room, but may be and evidently is largely diffused externally, those most from home, especially when fatigued by overwork, are most likely to suffer. But influenza readily affects those in close quarters. This winter at Hanwell Asylum fewer men with out-door work were attacked than women who were kept indoors. That women and children have no immunity from influenza was lately shown in the Lambeth Girls' School; and this is daily seen in families, where the youngest are not exempt, and where very persistent ill effects are observed during rapid growth and development in youth, as well as in the

various defects of age. The incidence of influenza among families, compared with larger homes, has less often been observed as the direct result of the introduction of a sufferer; it has sometimes seemed to follow from the reception of a visitor from an infected district, and then it does not always spread. When introduced in this way an interval of four days may occur; but visitors to an infected locality are often quickly seized. The infective agent of influenza is also capable of being reproduced in the bodies of the sick, and may there undergo some changes that alter its effects in some way, and perhaps increase if they do not confer upon it the power of direct infection. Thus the later cases may have fewer relapses, or more often have catarrhal symptoms, and be more infectious than the first. Some animals, chiefly those that are housed, as cats and stabled horses, seem to be peculiarly susceptible to the earlier epidemic agencies; and this is so far modified in horses that they largely communicate infection to other horses, but not to the men who look after them, nor is there any evidence of a more widely diffused prevalence of influenza in the districts around affected stables. As a part of this subject, it may be remarked that where in the present epidemic an early appearance of influenza has been noted the disease is there of old standing and the germ already existing ready to be raised into new activity, while in the later extensions to Egypt, India, New Zealand and China, the germ has been conveyed in the course of traffic, and the disease appeared at the intervals necessary to such means of transit. In all cases not only are favouring external conditions required, which seem only to come together at long and uncertain intervals, but a certain density of population is necessary towards carrying on the epidemic torch; for in isolated places and sparse populations only endemic outbreaks of no long duration nor large extension are to be expected. Besides the cases in Lincolnshire last year and in a village on the Yorkshire Wolds, a group of twenty cases, seven with pneumonia, occurred in Berkshire twelve months ago. Dr. Thresh reports cases in the north-east of Essex last November. Since Christmas

an isolated outbreak of influenza in villages of central Norfolk, near Watton, have come to my knowledge, while most of the recent extensions in this country follow upon communication with other parts already affected. A letter from Bombay dated March 7th informs me that influenza with pains all over, fever and cough, has reached there; but that old residents call it denguè. It is reported to have begun towards the end of February, attacking a good many people, especially natives, with sudden aches and coryza. The British and Indian troops in Lucknow were attacked soon after; 140 of the 17th Lancers, 450 strong and long at this station, were seized early in March before the disease had appeared in Calcutta. Influenza reached Umballa by March 22nd, when it was subsiding at Lucknow after affecting half the inhabitants. Much is said of influenza resembling denguè in some of its symptoms; but the pains and stiff neck of denguè follow the fever, which has a characteristic rash.

As to the second part of my subject, direct personal infection is certainly possible for influenza. Where this has occurred the incubation is short, and seldom more than two or three days. A longer period would point to an introduction of infected particles that had developed in the house to which they had been introduced. In some instances where all the members of a family have been affected sanitary defects have existed. Once house communication with an unventilated cesspool was found. Direct infection in this disease is probably always aerial; at least there is no evidence clearly incriminating the water-supply as a means of conveyance; but in this, as in many other directly infectious air-borne particles, we have to consider the distance through which it can act; for influenza, as for whooping-cough, this is most likely very limited, the particle must be carried somehow to the place where it is to develop. The great difference between a partly miasmal and a purely contagious disease has always to be remembered, and the possibility in the former case of the germ already being present to be considered; this possibility excluded, the rumours of ships having sailed into an infected atmosphere out at sea are fanciful. How small

is the infecting distance for influenza is indicated by the Brest training ships, when influenza having been introduced into one on Dec. 15th, attacking 250 persons, two other training ships lying quite near had not a single case. That children have often escaped in a family where the father has been ill with influenza is against any very active direct personal infection. That letters might be a means of conveying infective particles is of course possible; the instances in which such conveyance has been supposed to have happened are at best but inconclusive. The number of postmen and railway porters in London attacked may better be explained by their extra work and long hours of exposure at the Christmas season than by infection conveyed by means of letters or parcels. In one large post-office it was found that the telegraph boys and not the letter sorters were the first to be attacked. Doctors, it is true, often suffered, but the extra work thrown upon them during the epidemic had as much or more to do with this than direct infection from their patients. One point to be considered is mentioned by Dr. Sykes in his valuable report on influenza in St. Pancras—viz., that the more highly infectious a disease is, and the shorter the incubation period, the more difficult it is to discriminate between direct and atmospheric infection. This must remain one of the uncertainties of the epidemic. We cannot ascribe a long incubation to the atmospheric or malarial infection, and a short incubation to the cases from direct infection; for in the instances where a ship's crew were infected on arriving at an infected port, or on taking the pilot on board, the interval was a short one. Perhaps the sudden attacks, with fixed pains and fever, have a longer incubation than the catarrhal seizures. Herpes often occurs in both forms even without pneumonia or other pulmonary complications. Convalescents have a limited power of infection which seems extended in case of relapse, but is seldom evidenced by direct personal conveyance. The balance seems rather to be against direct personal infection as a frequent or potent cause of the spread of influenza, but sufficiently possible to enforce a caution against introducing a doubtful visitor amongst the weakly or infirm.

The best account of influenza made since the 1847 epidemic is that of the late Dr. Parkes. In some seizures the nervous or gastric phenomena are more frequent or attract more attention than the catarrhal; yet to contend that cough and coryza are not frequent symptoms of the disease would be not only to deny the identity of many previous epidemics, but the continuity of the present one and its relation to the various sporadic outbreaks so frequently and widely observed. Some of the great epidemics of influenza at the end of last century persisted for three years and subsided only for four or five; so we can hardly affirm that the disease had entirely disappeared in the interval, and that no sporadic cases occurred. There is reason to believe that such cases followed the last epidemic, and have again of late years reappeared; the more frequent use of the vague term "blood poisoning," may point to some of the less known results of this disease; an increase of diphtheria may be another indication of the approach of influenza. Beyond establishing that one attack of influenza will not give protection against a recurrence even in the same epidemic, and that a tendency to relapse must be admitted to be a feature of the disease, the present epidemic has not yet yielded an advance of scientific knowledge of it in any of those directions indicated by Dr. Parkes.

When after long quiescence an epidemic disease reappears suddenly, with features unfamiliar to many observers, the press of new facts is unfavourable to the quiet study of them; and panic, by a ready reversion to old fancies and false analogies, further confuses their view. To the old influence of earthquakes and volcanoes is now added that of volcanic or meteoric dust from the confines of our atmosphere and the illimitable space beyond. Comets and shooting stars are again invoked; but the times of the meteoric showers are known and coincidence is wanting. Fogs mephitic, dry, or luminous, are appealed to; though of some six or seven records of the latter phenomena only one, that of 1831, coincides with an epidemic period. A new view, that infective dust from our midst may be carried up by cyclones and deposited

elsewhere during anti-cyclones, has not been supported by comparison with the daily meteorological maps that are at hand. The search for a centre of origin for certain epidemics starts on analogy drawn from an old biological view of centres of distribution for plants and animals; but our views of Australia as a centre for marsupials change when we find fossils of this class in Oxfordshire and in the oolites generally. The reasons for assigning centres of distribution to plague, cholera and yellow fever, do not apply to influenza. Moreover etiological speculations of this kind distract attention from calm observation of the disease itself, and interfere with a steady prosecution of the natural history of influenza and its relationship with epidemics of pneumonia, laryngitis, herpetic catarrh, and catarrhal jaundice; perhaps even with a form of diphtheria, or an allied endemic passing under that name, less directly contagious than the more formidable and fatal malady.

A Russian resident in St. Petersburg informs me that influenza has of late years been prevalent there at all seasons, and is dreaded less in its catarrhal form than as a complication of the common fevers of that insanitary capital. We have seen in this epidemic that chest pains and dyspnœa may occur without pulmonary affection, also that other peculiar nervous symptoms are in no direct ratio to the extent or violence of what has been called the "membranous catarrh," and that if these are at first related to the degree or continuance of fever, they certainly last beyond it; while the mental hebitude, stupor, or drowsiness, come still later. In this epidemic affections of the pharynx, tonsils, tongue and mouth, with herpes of the lip, have been seen oftener than in the last, but perhaps not more than in the preceding, for then Dr. Robert Williams noticed vesicated lips as a symptom.

53, *Harley Street, Cavendish Square, W.*
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